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Re: 3d

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION III

841 Chestnut Street  
Philadelphia, Pennsylvania 19107

ORIGINAL  
(Red)

May 10, 1991

SUBJECT: Salford Quarry Site  
Evaluation of Naturally Occurring Boron in Groundwater

TO: Cesar Lee, RPM  
SE PA Section (3HW21)

FROM: Jay Newbaker, Hydrogeologist *J.N.*  
Technical Support Section (3HW15)

As requested, I have reviewed historical and background information regarding the nature and extent of boron contamination at the Salford Quarry Site. Specifically, an attempt was made to determine the amount of naturally occurring boron present in the groundwater within the study area in order to ascertain the extent to which the Salford Quarry site has contributed to the elevated levels of boron detected in the aquifer.

In general, boron concentrations as high as a few tenths of a milligram/liter are commonly found in "typical" surface water and groundwater (Matthess, 1982). Tourmaline, the most widely distributed mineral in which boron is an essential constituent, along with biotite and amphibole are expected to be the major sources of boron in groundwater in nonvolcanic areas. The minerals colemanite and kernite also contain considerable amounts of boron but are mainly found only in evaporite deposits in the western U.S. Lastly, commercial and industrial uses of boron as well as the use of borax as a cleaning agent can contribute to the occurrence of boron in sewage and industrial wastes (Hem, 1985).

The source of any naturally occurring boron in the site vicinity would be expected to be related to the presence of any of the aforementioned minerals in the local bedrock, namely the Brunswick and Lockatong Formations. None of these minerals are listed as major constituents in either of these formations (Longwill and Wood, 1965). However, The presence of relatively minor amounts of boron containing minerals in the Brunswick and Lockatong Formations cannot be discounted. Argillaceous rocks such as the Lockatong Formation are known to have boron concentrations of 194 mg/kg while sandstones can contain *AR 902352* (Matthess, 1982).

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Note that no information on the amount of boron or boron containing minerals in the rocks of the Lockatong and Brunswick formations was located. Furthermore, other than the groundwater investigations conducted for this project, no other information on the amount of boron naturally present in the groundwater in the site vicinity is available. Groundwater investigations conducted by the USGS in the 1960's did not include trace element analysis (Longwill and Wood, 1965). According to Ron Slotto of the USGS WRD Subdistrict Office in Malvern, PA, the closest area to the site for which boron information is available is in Chester County. The median concentration of boron from 98 groundwater wells in this area was below the detection limits of 10-15 ppb (5/9/91 teleconference).

In closing, concentrations of boron in the groundwater in the site vicinity above approximately 500 ppb cannot likely be attributed to natural causes. Since concentrations of boron in the groundwater on and immediately adjacent to the site are on the order of hundreds of ppm, the most likely source for the boron are the tile wastes located at the Salford Quarry Site.

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#### REFERENCES

1. Hem, John D. Study and Interpretation of the Chemical Characteristics of Natural Water, Third Edition. U.S. Geological Survey Water-Supply Paper 2254. Second Printing, 1986.
2. Longwill, Stanley M. and Wood, Charles R. Groundwater Resources of the Brunswick Formation in Montgomery and Berks Counties, Pennsylvania. Bulletin W 22. Pennsylvania Geological Survey, Fourth Series. Harrisburg, 1965.
3. Matthes, Georg. The Properties of Groundwater. Translated by John C. Harvey, B.A., B.Sc., Ph.D. (Lond.). John Wiley and Sons, 1982.

cc: Charles Hayden (3RC21)  
Bob Davis (3HW15)

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